Apr 28th, 2:00 PM - 5:30 PM

Paper Session II-C - The U.S. Commercial Space Launch Industry: Responding to the Market

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The U.S. Commercial Space Launch Industry:

RESPONDING TO THE MARKET

By
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INTRODUCTION:

The International Space Year, 1992, was an ephemeral period that helped usher in a new exiting era in commercial space launch. This era will include further globalization of the industry, with sharply broadened international business relationships being established that wouldn't have been possible a few short years earlier. Greater cooperation is occurring among the nations of the world conducting space research and exploration. Former adversaries are now business partners. New technologies and smaller systems hold the promise of the economical proliferation of new commercial communications systems that will change our lives.

The fall of the Warsaw Pact and the dissolution of the Soviet Union have created dramatic changes and opportunities for the U.S. commercial launch service providers. These challenges require equally bold responses. With the signing and forthcoming ratification of the START II Treaty, a reduction of the U.S. strategic defense space launch requirements will occur accompanied with a shift in space policy focus. Historic opportunities are now possible to convert the over capacity of military capabilities to value added, high wage, high growth commercial activities.

Coupled with these events is an emerging market for the launch of small commercial satellites that is predicated on the worldwide need for mobile communications services. As the global economy has become more intermeshed the need for modernized communication systems in developing regions and newly independent regions has grown to enormous proportions. Latin America is expected to spend over $110 billion by 2000 modernizing telecommunications in the region. Development and trade activity is very closely tied with the ability to communicate freely. Terrestrial communications in developing nations are expensive to initiate and install and even more expensive to maintain and operate. The most cost effective way for a region to join the modern telecommunications world is via satellite systems. A new element in satellite communications that should be available in the next 4-5 years is mobile satellite cellular service. In this concept the terrestrial cellular tower is replaced by a system of low earth orbit (LEO) satellites. One of the proposed private systems requires 66 satellites for global coverage. There are eight proposed systems pending FCC approval that could require the launch of up to 250 satellites costing a total of $7 billion. Not all are expected to be built and operated but the successful systems will clearly impact the marketplace for commercial launch services in ways that can yet be imagined. Responding to this market will require serious attention by U.S. launch service providers and a new approach to launch site infrastructure and regulatory procedures by government authorities.

The U.S. invented the launch market for commercial telecommunications satellites in the 1960's and dominated the industry for two decades. Today we face increasing foreign competition in the launch industry as well as in the more lucrative satellite manufacturing and satellite services industries. The European consortium Arianespace is clearly recognized as the commercial launch industry leader with over 50% of the global market. The $5 billion U.S. commercial space industry has been the leading aerospace growth sector, despite the U.S decline in commercial launch market share. It is a significant factor in the face of the declining defense and civil government aerospace markets in 1991, 1992, and similar projections through the remainder of the decade. The Department of Commerce predicts commercial growth at an annual rate of over 14% for the remainder of the decade. Coupled with predicted flat growth in future NASA budgeting, the commercial space market will surpass NASA budget appropriations by the year 2000. In addition serious advances in space telecommunications projects and technologies described above, could move the commercial growth projections even higher.

The mainstay of the current commercial launch market has been the medium class telecommunications satellite that is positioned in a fixed geosynchronous earth orbit (GEO) 2 degree slot 22,300 miles above the earth. The satellites are usually manufactured over an 18-24 month process can cost as much as $100 million, and are expected to generate over $1 billion in revenue in a ten

year life span. They can require as much as a $500 million investment in ground infrastructure to be fully utilized. The average launch costs are between $50-60 million dollars. Insuring a satellite launch varies between 16-20% of overall satellite cost and it can take as long as five years from planning to on-orbit operations of a single satellite.

This is a mature well defined market with a limited number of participants and a small number of very expensive launch events annually. With the relatively small number of funded medium class payloads (Department of Commerce estimates 12-16 annually) and the expanding line-up of international launch services available, it is today, without question, a buyers market for commercial launch services. Commercial space launch customers have more alternatives than ever to the once dominant U.S. launch services.

The key element in the discussion of promoting the U.S. commercial launch industry, is the need for change. Change is mandatory in our approach to industry regulation and oversight, change is clearly needed in our approach to planning and execution, change is required in our long term vision for the U.S. commercial space launch industry. The Clinton administration comes to the industry table with a mandate to change the way government does business and to break the commercial space policy grid-lock in Washington. The commercial space launch industry is a potential test case to invoke new economic theory, and reinvigorate a vital U.S. industrial base, before we succeed in exporting another high wage, high growth industry that the U.S. once lead.

INTERNATIONAL COMPETITION

The September 11, 1992 decision by the Bush administration granting several U.S. manufacturers of satellites 5 export licenses to China for launch on the Long March vehicle, was viewed by many industry experts both U.S. and European as being motivated by political ramifications rather than strategic trade issues. The State Department announced the decision without the normal consultation with other agencies such as the Department of Transportation. DoT fears that a non-market economy such as China could dilute an already thin marketplace with a launch service that cannot be compared on an equal basis with western launch services. A State Department representative declared that the agreement would create jobs and reduce the deficit balance of trade with China. The effect on the balance of payments was only partially correct. Three of the export licenses will be for non-Chinese organizations to purchase the satellites, consequently the trade impacts will be with those nations. The overall effect however is a net loss of revenue for domestic launch service providers and that could reduce jobs and weaken the industry. The signals sent to financial interests could be interpreted as destabilizing and therefore increase the risk assessments to the investment capital markets, further weakening the launch service industries ability to borrow.

Much discussion has taken place over the entrance into the world launch services marketplace by both China and Russia (CIS). There influence is feared by the U.S. and European launch service providers alike. The arguments put forward include suggestions that China and the CIS will be dumping services on the open market that do not fairly reflect costs because of their socialized political structures. The U.S. and Europe should tread very lightly in this area. Protectionist attitudes can easily influence those organizations that are not currently operating in the true private sector to begin with.

It is entirely correct to say that the Chinese have a different system for determining the fair market value of their launch services and this could be harmful to international competition based on fair market systems. It is quite different however in the case of the CIS. The former Soviet Union had an industrial production and launch capability that at one time was capable of putting over one hundred payloads into orbit per year. The U.S. has been averaging a little over 20 orbital launches per year from the Cape at near full capacity as determined by the Air Force. During the first 48 hours after the invasion of Kuwait the Soviets launched seven military payloads into orbit. The explanation for this robustness is the development of standardized cheap expendable launch systems and relatively simple standardized spacecraft. By complete accident the former Soviet technologies are very commercially competitive by western standards, and the near launch on demand capabilities, are the commercial launch service providers Val Halla. The point is, their robustness is not a function of investment in advanced sophisticated spaceflight hardware and infrastructure as much as an investment in simplified industrial engineering processes that work quickly and efficiently and could be termed very market oriented. The Russians were recently allowed a one time exemption to compete for the launch of an American made satellite owned by Inmarsat. Their bid price was almost 40% lower ($35 million) than the closest European or U.S. launcher (approximately $60 million). Space experts visiting the CIS recently commented, that because of their effective industrial engineering approach to mass produce vehicles and provide swift integration and launch, their bid price could indeed reflect

the true costs of launch service that could be compared on an equal basis with western market oriented organizations.

The U.S. will be forced to respond to this segment of the competitive environment. The Russians have asked for greater U.S. cooperation and help in marketing practically everything that is not bolted down in their space program. India has already indicated interest in Russian made propulsion systems. The Japanese held talks of purchasing various Russian systems up to and including the MIR space station. Russian Zenit boosters could pop up at a number of potential sites including Kourou as strap-on boosters for Ariane V. While the Europeans are denouncing the Russian entrance into the commercial launch industry, they are moving along signing agreement after agreement with the Russians regarding the use of the MIR and manned spaceflight technology, and are even considering Russian entrance into the European Space Agency. The French and Russians have also recently conducted joint hypersonic scramjet test (Nov. 17, 1992), and signed a long term hypersonic research agreement. The huge U.S. lead in hypersonics technology we once held appears to be dwindling rapidly. This is a critical 21st century technology that the Russians offered to jointly research with the U.S. first. After the U.S. turned down the opportunity they found new partners quickly. By ignoring or discounting the Russian overtures we have helped create our new competition in this technology.

One unique response to the marketplace was a December 29, 1992 announcement between Lockheed Corporation and the Russian Khrunichev Enterprise that manufactures among other things the Proton expendable launch vehicle. Lockheed /Khrunichev International (LKI) will be a joint venture that will permit Lockheed to market the Proton launch vehicle and conduct payload integration at the Baikonur launch site in Kazakhstan or Plesetsk in Russia. This will provide Lockheed with access to the commercial launch services market through a reliable launch system with huge commercial potential.

The impact of LKI agreement is not as clearly negative as some U.S. launch interests would like to believe. The U.S. does not dominate the commercial launch industry the Europeans do. It is not clear whose market share is more vulnerable to the Proton. The U.S. manufactured communications satellites will be sparingly allowed export licenses for launch by Russia. The Proton could actually be of greater threat to Arianespace dominance than to the U.S. segment. The threat presented by the LKI agreement to 10% or even 20% of the domestic launch industry revenue stream does not out weigh the benefit to U.S. / Russian trade, the potential for launch technology transfer improving the long term U.S. launch industry, and the prevention of further domination of the market by European interests. The Lockheed response to the international market environment may be the most appropriate from our current market position.

Rocket Systems Corporation of Japan has already entered competition for commercial launches before the first flight of their H-2 booster, bidding for an Inmarsat-3 satellite launch contract. Three H-2 test flights are planned in 1993 and 1994, with the first commercial payload expected to be launched by 1995. Rocket Systems is lobbying the Japanese government to lift the restrictions by local tuna fisherman that prevent more than 2 launch windows (in February and August), per year from the Tanegashima launch site. Their launch site is 30.5 degrees north latitude on one of the southernmost islands of Japan. The H-1 rocket was licensed U.S. Delta technology and by agreement could only be used for the launching of indigenous National Space Development Agency (NASDA) payloads essentially freezing Japan out of the commercial launch industry. The H-2 is the first completely Japanese booster and allows unrestricted entrance into the commercial marketplace.

Here again we find Rocket Systems Corporation a consortium of 77 Japanese industrial firms, banks, and insurance companies lead by Mitsubishi Heavy Industries, working cohesively with the Japanese space agency NASDA similarly to the ESA–Arianespace relationship. Rocket Systems will oversee production and marketing of the H-2 after the initial flight tests are conducted, and will also handle final testing, quality control, user development,advanced planning, and some launch site operations earlier done by NASDA, very similar to the ESA–Arianespace working relationships. The H-2 will also be very similar in performance to the Ariane-4, but currently has a much higher price tag of about $110 million per launch. Rocket Systems hopes to reduce booster costs by gaining efficiencies from placing block orders of boosters, again strikingly similar to Arianespace.

According to industry processing teams contacted the $330 million dollar H-2 facilities complete with Vehicle Assembly Building and crawler at Tanegashima rival those at Kourou or the U.S. for modern state of the art processing of commercial payloads. Many commercial analysts feel that this commitment by Japanese interests coupled with their overwhelming international trade experience could add considerable competition to an already rabid marketplace. The Japanese response to the market looms formidably on the commercial launch industry horizon.

WINNING STRATEGY

In today's marketplace for U.S. launchers there appears to be several structural and policy disadvantages that helps create competitive weakness. Those disadvantages include the obvious aging flight hardware technology and support infrastructure, but they also include a regulatory policy system that is in need of complete review and restructure to accommodate the post-cold war realities of the global marketplace. Addressing technology issues without curing the industry regulatory problems will not guarantee improvement in the U.S. competitive position. Addressing the regulatory issues immediately, will provide a significant competitive stimulus in the shortest period of time for minimal costs. Combining both approaches is a winning strategy.

The U.S. commercial space regulatory system that has evolved over a number of years and is encumbered with safety, cost, and scheduling, requirements that have served adequately the cold war era military and civilian government launch segments but do not successfully address the post-cold war commercial launch industry competitiveness issues. Almost every discussion in the recent past regarding the space launch industry has been from a perspective that placed more significance on the national security strategic interests control over launch sites and launch capabilities, than on the development of commercial markets. For the commercial launch industry to proliferate a basic national policy priority shift must occur.

Commercial space transportation must be considered a basic regulated commercial industrial operation and allowed to become a normalized transportation segment. The demystification of the processes and problems associated with transporting payloads from launch site to orbit is the foremost challenge presenting the U.S. industry. It is possible for national security to be maintained and commercial industries to thrive coincidentally. Airports and seaports have mastered these obstacles for decades and it is now time for the space transportation industry to overcome the same parochialisms that have limited the growth of U.S. commercial launchers. Our international competitors have successfully normalized their launch services. The current regulatory environment administered by the military no longer serves the nations long range goals in space. To compete we must embrace the changes required and move on. The post-cold war era now allows new thinking and innovative solutions to old regulatory issues. The global market place for space launch services is no place for government agency turf battles, protectionism, or isolationism.

OLD THINKING:

The most serious U.S. launch industry competitiveness factor is "old thinking". Blue Ribbon panels have been convened in the past several years to make recommendations on the future of the U.S. space program including the commercial launch industry. All have been headed by well meaning individuals caught up in a system congested with cold war based "old thinking". Issues and recommendations regarding commercial space that resulted were listless. The best description of the effects of "old thinking" is the graying of black and white issues, the blurring of lines of authority, and the issuing of authority without responsibility or accountability. No consensus is established no sense of direction or definitive strategy imparted and consequently the ideas and recommendations become muddled and are largely ignored. Most large, multi-year, multi-federal agency space technology programs have taken on many of these characteristics. They no longer appear to provide the Apollo style enthusiasm and dedication. They attract a different element, one that is more cynical and pragmatic and less idealistic and energetic. The U.S. can no longer afford more of this type of leadership in the commercial space industry.

An example of "old thinking" is the recent "Spacelifter" recommendation. Even if the decade long development period could be somehow mitigated, this approach to solving our technology problems no longer works. By combining all the requirements of the government and commercial industry into one core vehicle, it is doomed to failure under the weight of its own requirements. Mixing the requirements for manned and unmanned vehicles as well as Defense and commercial contracting, will dilute the benefit of any new technology gains.

The Air Force C5 heavy lift military aircraft, designed to transport troops and armor with a high degree of operability from less developed airfields, has never been utilized for commercial cargo operations. Commercial market forces dictated the more reliable and less expensive and simpler design of the Boeing 747F. Both aircraft have specific roles and serve their respective markets well. Mixing both requirements into one vehicle would have resulted in an inefficient expensive design serving neither.

NEW THINKING:

Privatization and industrial commercialization is taking root around the world in places were former military dictatorships, juntas, and communist authoritarian states once stood. The role these former governments have

played in restricting the economic growth and debilitating the advance of international trade in their regions is now clear to their populations, and with few exceptions seems very unlikely to return. The rest of the world seems to be committed to developing global markets, regional trade agreements, and generally competitive economic harmony. One exception appears to be the approach to governing and regulating the commercial space launch industry in the United States. Today the Air Force seems pitted against other federal agencies and is more concerned with protecting historical turf, than cooperating with commercial and civilian organizations to regain U.S. competitiveness in this marketplace.

When Europe developed the Ariane vehicle, it was designed from the very beginning to accommodate commercial payloads. A very important decision occurred in 1978 that was to determine the fate of the European commercial launch industry. The Europeans recognized the proper role for governments to play in commercializing space launch technology. Basic technology research and design functions that require large infrastructure and facilities which can serve other space systems design, were determined to be the proper role for the European Space Agency (ESA). In January of 1980 the member nations agreed to allow the Ariane booster to be mass produced and marketed by the first private launch service organization Arianespace. This decision is now regarded as an epic crossroads in European and the global space industry.

The Europeans determined that operating a fully functional space launch system was the role of the private sector. Negotiating booster manufacturing, marketing, financing, underwriting, and conducting the launches are all handled by a relatively small cadre of specialists (just over 200) with the speed and flexibility that only the private sector can provide. Arianespace is a private corporation created under French Napoleanic law that allows Centre National d'Etudes Spatiales (CNES) the French Space Agency to be a partner along with 36 private European aerospace and electronics companies and 13 major banks. Combining all these resources and not becoming overwhelmed by bureaucracy is in itself somewhat of a marvel. Arianespace is by no means perfect, however their success in the marketplace is difficult to dispute.

CUSTOMER ORIENTATION:

One of the subtle differences between the Arianespace operation at Kourou and the the commercial launch operations at the Cape is the level of attention paid to the customer requirements. In a commercial industry were there is more than one buyer and seller the amount of attention paid to a client or potential client is an important part of the product or service marketed. Arianespace appears to understand these factors better than the Air Force at the Cape, because it is a private organization and conducts business mainly with other private organizations.

According to the commercial satellite owners and processing teams contacted for this study, there is a high degree of attention paid to requirements of the Range at the Cape, with a minimal degree of attention paid to the requirements of the commercial customer. The initial review of a spacecraft to be launched from the Cape is conducted by the Range beginning long before its final assembly. The disposition of the Range requirements can and usually does take from 4 - 8 months. If any additional customer requirement occur in that time frame prior to arrival at the Cape (they almost certainly do) they are likely to receive even less of a priority than the initial Range requirements. Processing teams and customers consequently arrive at the Cape and spend a great deal of expensive processing time chasing approvals for minor changes and late requirements. According to the customers contacted, commercial processing teams are treated as something abnormal that happens to occur infrequently at the Cape, as opposed to the normal government payload customers. The entire process has been termed by all former customers contacted as highly adversarial (a search for problems) rather than participatory in its approach.

When discussing certain campaigns or processing teams with Arianespace their representatives are quick to name key members of teams as respected professionals. The Arianespace managers could discuss by name team members and how much experience each had, how many launch campaigns they have worked, and in some cases organizational idiosyncrasies. A higher degree of comradre appears to evolve in this process between the processing teams, customers, and Arianespace. The small size of Arianespace (approx. 200) and the low turnover rate of launch site personnel may account for part this phenomena. However it goes to a much deeper organizational commitment to service. Several of the teams stated that the U.S. companies provide launches and Arianespace provides launch service. The huge number of people involved in the processing approval and launch activities at the Cape and the constant turnover of key military personnel does not allow this accumulated customer knowledge base to occur. When discussing satellite processing teams with A/F approval offices the

conversation usually shifts to the launch service provider teams as the best known and trusted personnel and the payload customers and manufacturers are associated with being outsiders.

To effectively respond to the market an attitudinal adjustment in orders of magnitude is required, or a complete shift to a civilian run customer oriented commercial launch industry at the launch sites. NASA had earlier assumed the role of marketing commercial launch services on the Space Shuttle in the early 80's. The results were heavy subsidy, constant delays, and gross inefficiency. The Challenger accident and subsequent policy change removed NASA from the marketplace. Currently the U.S. Air Force is not faring much better in overseeing the commercial expendable vehicles. The Air Force maintains the manifesting, controls access to facilities, and generally disrupts the other market forces which dictate to commercial payload owners when and for how much a payload should be launched. With the European approach those functions are only entrusted to the customer oriented private launch authorities, and they just happen to be the most successful commercial launch organization in the world, Arianespace. This type of new wave government industrial policy that defines the government role in commercial space as purveyor of basic technology research, is being applied in Japan, and even the former Soviet Union. Soon to successfully compete, the U.S. will be forced to alter its approach to regulating the commercial space launch industry or be driven from the marketplace.

U.S. COMMERCIAL SPACE POLICY AT A CROSSROADS:

The government is by far the largest single customer of U.S. launch services and today only a fraction of those services are procured commercially. With only one customer dictating non-market, government procurement oriented procedures and requirements, the impact is felt by the smaller commercial market sector as well. By responding to the needs of the government, U.S. launch service providers have incurred built-in overhead that acts as a deterrent to international competitiveness. The unabridged documentation requirements, the government's rigid inefficient procurement process, the convoluted launch approval process, the layers of government authorities, and the general government works program approach to the launch industry, have stacked the deck against U.S. commercial launch service providers.

The Cape and other launch sites have over the years been accustomed to large government programs covering multiple launches of medium and large payloads which can last many years. Commercial customers with a single medium payload to launch every so often, are foreign to this cultural environment. The impact of commercial space on the Cape operating environment to date has been minimal. Payloads are approved, integrated, tested, and launched with little regard to their pedigree. Medium class commercial payloads in general have been assimilated into the existing launch operations infrastructure and treated very similar to government payloads

Just over the horizon however are several commercial projects now being planned that could provide the growth opportunities and launch activity needed to stimulate a new commercial marketplace. These new commercial payloads will be smaller with improved miniaturized technology and less expensive to manufacture, launch, and operate. They pose minimal technological risks and in most cases require little or no development time, can be prepared and launched with a small very responsive team. Lightsat or small satellite technology has been around for a long time. The need for for small systems in the past were generally for unique missions, or basic research, and never generated the serious interest that would stimulate the investment in small launch system infrastructure.

SMALL PAYLOAD LAUNCH

The emerging market for small satellites to conduct useful research and provide commercially viable applications appears to be coming to fruition. The widespread use of small systems has not occurred until now because of the success of the larger GEO commercial payloads, and the reliance by the government systems on large long lead time projects.

They are driven by the need for global commercial communication services and not government procurements. The Low Earth Orbit (LEO) communications satellite constellations that have been proposed by eight different organizations vary from constellations of 12 to 66 small satellites (under 2000 lbs.) per system. The LEO communications systems will provide cellular communication with space based resources instead of ground based antennae cells. The larger more expensive systems will offer voice, data, and FAX. The smaller systems will deliver data and FAX. Most will provide positioning and location services, either independently or linked to the Global Positioning System.

There is one common question that arises during every discussion of the LEO 's "Is the market real?" The market for the LEO satellite communication systems is as

real as the cellular market. The existing cellular industry is one of todays fastest growing communications sectors with over 100,000 cellular phones sold daily. The LEO systems offer a dramatic extension and global expansion of this marketplace. Mobile communications systems have the potential to alter and stimulate the global business culture, play an essential role in emergency disaster relief, enhance the work of environmental monitoring systems, and provide a stabilizing effect on political environments. Recent articles have appeared in the Wall Street Journal quoting financial analysts lend credence to the market potential for these ventures. The question now is not so much "is the market real", but how much market is there, and which organizations will actually make it.

market share. With thin profit margins the launch site costs will have to be controlled a great deal more than with medium class payloads.

Currently the Federal Communications Commission is reviewing license applications. Several licensees expect to be fully licensed by the summer of 1993. The combined total of these proposed systems could require as many as 250 launches by the year 2000 with a price tag of over $7 billion. Not all plans will come to fruition, however the U.S. launch industry should be taking steps now to reap the benefits of this growth sector.

IMPACT ON THE CURRENT LAUNCH MARKET

LOW EARTH ORBIT (LEO) COMMUNICATIONS SYSTEMS

	SYSTEM	ORGANIZATION	NO. OF SATELLITES	ORBITAL LOCATION	INITIAL OPERATIONS	PROJECTED COSTS
BIG LEO's	IRIDIUM	Motorola	66	LEO	1998	$3.7 BILLION
	GLOBALSTAR	Loral/Qualcomm	48	LEO	1997	$875 MILLION
	ODYSSEY	TRW	12	MED. ORBIT	1997	$1.4 BILLION
	ELLIPSO	Ellipsat Corp.	12	ELIPTICAL	1996	$254 MILLION
LITTLE LEO's	ORBCOMM	Orbital Communications	24	LEO	1995	$255 MILLION
	STARSYS	NACLS, Inc.	24	LEO	1995	$250 MILLION
	AIRES	Constellation Communications	48	LEO	1996	$292 MILLION
	VITASAT	VITA Corp.	3	LEO	PHASE I OPERATING	$10 MILLION
	LEOSAT	Leosat Corp.	18	LEO	1996	$100 MILLION
	TOTALS		256			$7.136 BILLION

The LEO satellite market has the potential to institute an entirely new approach to commercial launch service. Throw weight muscle will be replaced with efficiency, flexibility, and operability. Today the infrastructure at the Cape and other facilities is barely compatible with todays marketplace. The LEO systems will force a degree of operability that cannot be met in terms of existing capabilities and facilities. To date the U.S. launch site operators have not acknowledged the requirements to support the LEO launch market. The magnitude of this potential needs to be analyzed by the Department of Transportation. Long range planning and infrastructure funding needs to be determined and a plan of action committed to. Ground support systems will be required to handle peak loads of launch activity during satellite initial activities and future system upgrades. Today's GEO satellites are usually replaced after there ten year life span with a larger capacity spacecraft. Station keeping, guidance and control technology, and routine functions have changed very little over the development cycles. The LEO systems will be smaller more numerous and flexible. Technology obsolescence driving system upgrades will be

The LEO systems will require multiple launches for initial operations. Integrating multiple satellites is not completely foreign to the Cape but will require a much different approach to test and checkout, safety approvals of multiple identical satellites, and scheduling of limited resources along side the current market for medium class GEO payloads. Low earth orbit payloads will have limited life spans of 4-5 years as opposed to 10 for GEO satellites. Satellite replacement, upgrading, and logistical flights will require a near launch on demand capability. The new systems will be highly competitive, therefore reliability and maintainability will be key to providing quality customer cellular and data services and capturing

a constant issue with the service providers looking to maintain a competitive edge.

The commercial launch market will be drastically affected by smaller spacecraft with more launch frequency. There will be new opportunities for federal, state, and industry relationships based on mutual benefit from a growing dynamic space launch segment. New approaches will need to be tested including technical and non-technical. Space launch insurance for multiple satellite systems will present different risk analysis issues for underwriters. The larger number of events should help benefit both spacecraft and launch vehicle manufacturers with improved industrial engineering practices and efficiencies of scale. Producing satellites in groups of 48 instead of individual custom orders, will create a production system that can drive similar improvements in launch vehicles and ground support equipment.

The LEO industry competitiveness will force a new criteria for launch response times. Having single or multiple failures in an operating communications constellation, can affect the revenue stream but even more importantly can allow ones competitors a significant marketing advantage. Reliability and dependability is evident in todays competition in the long distance telecommunications markets. Sprint, MCI, and AT&T are all competing on service more than any other factor. For the LEO systems to provide quality reliable service, a logistical support system that includes on orbit spares, rapid response launch vehicles, and flexible launch scheduling is essential. These factors are all desirable today but will be almost required to support the LEO market. The launch site infrastructures and procedures will need to considerable change to achieve these goals.

Smaller systems are much more vulnerable to the effects of fluctuating launch costs. A new approach will be necessary by the launch site in defining expenses and holding the line for identical launch processes. Commercial operators can reduce substantial business risk with reliable predictable costs. The Cape and other U.S. sites will have to minimize and control launch costs and stabilize the overall environment to insure the LEO system organizations of reliable business planning data long before the satellites reach the launch site.

SMALL PAYLOAD MARKET POTENTIAL

The small satellite market has enormous potential for applications other than communications and navigation. Remote sensing systems now rely on medium and large satellites that take an average development time of 4-5 years and cost hundreds of millions of dollars. The only investors to date have been governments and only a few systems are in continual use. The U.S. Commerce department has sited remote sensing as a potential growth segment of the commercial space industry if certain issues can be addressed. The volatility and value of commercially useable data from remote sensing satellites is now limited because the satellites in polar orbit overfly a particular region only once every 14 days. Studies have shown the commercial usefulness of the data increases with the increased frequency for comparison. Constellations of smaller satellites over flying the same regions daily, the data can become more useful information regarding agriculture and resource management. One proposal by Dr. Edward Teller is based on the military Brilliant Eyes program. The system would consist of 48 low earth orbiting satellites constantly observing the entire globe. Technology for detecting military launches can be directly applied to detecting impending crop failures. The Indian Space Research Organization has lead the field for many years in the development of cost effective small remote sensing technology that can serve regional environmental monitoring, water and resource development, and sustainable agriculture. They will obviously participate in the future development of these technologies. NASA's once huge Earth Observation System platforms have been broken up into smaller segments, though still not considered lightsats, every indication is the trend is for even smaller EOS platforms.

The University of Surrey, U.K., the Norwegian Space Center of Oslo, and Arianespace have all conducted recent studies analyzing the markets for small satellites. The results point towards a growing market for small payloads that will change the complexion of the launch industry in the next 2-3 years. Small entrepreneurial launch vehicle builders who struggled to remain afloat during the past decade are increasingly optimistic about the 90's. Names like American Rocket Co., Orbital Sciences Corp., EER Systems, Microspace International, Bristol Aerospace, are expecting a share of the estimated 12-24 launches annually by 1999. The future market potential based on current demand does not take in consideration the potential for advances in data processing and sensor fusion applications or a growing demand in a newly invigorated post-cold war world. Traditional names in aerospace such as Motorola, TRW, Loral, Lockheed, Fairchild, and others are entering the small satellite market with multi-million dollar investments adding tremendous credibility to the segment. The United Nations authority is growing as is the interest in providing the benefits of space technology to the developing nations

of the world. The 1992 "Rio" Earth Summit amplified the need for high tech agriculture, resource management, and environmental monitoring on a more global scale. The environmental industry is targeted by many as they next major growth industry.

RESPONDING TO THE MARKET

The next major market for launch services is now emerging. Small satellite systems that reduce technology risks, development time, and up front investments are destined to play a significant role in future space launch activities. The U.S. launch industry is now at one of those crossroads that occur so few times in a human life span. Strategic business alliances are now being formed across the globe that will have implications affecting the commercial launch market for decades. The U.S. launch industry infrastructure and policy is not prepared for this event and may be overwhelmed if actions are not forthcoming. The launch industry and regulators need to consider a blank sheet of paper approach to stimulating the market for LEO satellite systems and other small payload launch. These systems will have heavy front end costs and razor thin profit margins as compared to the current medium sized payloads, the effect of delays and cumbersome range requirements could force the market to develop elsewhere.

The U.S. government and industry has a limited window of opportunity presenting itself in the case of the LEO systems and small launch market in general. The next 3-6 months will see the approval and licensing process take place along with strategic financial relationships established to promote these systems. If U.S. launchers and launch sites do not actively pursue this new market segment, others will. By inaction or inappropriate action we will help create the next generation of competitors for U.S. launch service providers and in all probability seal the fate of the U.S. commercial launch industry. A strategic effort needs to be initiated by commercial agencies now, to lead an organized comprehensive response to this emerging market before the U.S. finds itself reacting again to the vision of others.

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Ralph De Palma is a commercial space consultant with 22 years of aerospace experience, and is based at the Cape. His experience includes commercial launch operations and international marketing of space technologies. His current activities are focused on the impact of the LEO satellite systems on the Cape launch facilities and the international markets for LEO communications services.